A Nuclear Powered Argentine Submarine?

This blog post was first posted to the International Centre for Security Analysis blog on the 21st July 2015.

Argentine Defense Minsters have repeatedly claimed that Argentina has a viable nuclear submarine program underway. The program has been stated to use the CAREM reactor, but it appears nobody told the CNEA, the Argentine Nuclear Agency responsible for the reactor. The civilian nuclear energy agency states that the CAREM reactor is a modular power plant that will be used for power generation in remote regions, power for high-energy use industry and desalination. CAREM-25 is Argentina's first indigenous designed and built power plant. The reactor building is currently under construction near the town of Lima in Buenos Aires Province.

What is the origin of the difference of the stated purpose of the CAREM reactor between the civilian and military establishment? The projected optimism of the political establishment may be due to competition with the Brazilian submarine program. Can an Argentine politician publically admit to being left in the dust by the Brazilians?

The CAREM-25 reactor is a small 27MWe modular reactor and appears to be inherently unsuitable for use in submarines. Firstly, it's just too big. The submarine that is widely touted for use, the TR1700 would be retrofitted with a nuclear reactor but even with a new submarine design, the current generation of CAREM is simply too large.

It also needs to be refueled too often. When US submarines are aiming to never be refueled in the lifetime of the vessel CAREM-25 requires yearly refueling. Refueling a submarine is far more troublesome than reactors on land. The core is not accessible without the reactor section being removed from the submarine entirely leaving the submarine in port for around 18 months. This would leave an Argentine submarine with a woeful 40% duty cycle.

Finally, the SCRAM mechanisms, or emergency safety mechanisms, are stated to rely on gravity. This is also not seen as viable for a submarine reactor that can pitch and roll in the ocean.

CAREM-25 is the first generation of this reactor design; a 150 MW reactor: CAREM-150 is being explored and will include an updated reactor design. The unsurpassable problem is based on the type of fuel: CAREM-25 will use a UO2 ceramic with low ~5% enrichment. It is the low energy density of this fuel will limit the refueling time.

There are important questions over using CAREM reactors in an Argentinian submarine programme. The public rhetoric from the government at this moment just doesn't seem to agree with the current state of the technology.